SYSTEM FOR REPLACEMENT OF SHEET ABRASIVE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of provisional application number 60/461,392 filed April 8, 2003.

TECHNICAL FIELD

This invention relates to systems for rapid replacement of abrasive in machinery which uses the abrasive to finish the surfaces of workpieces that pass through the machinery on a belt, such as so-called widebelt sanders.

BACKGROUND

The basic features of surface finishing machines of the type that represent the preferred environment for the invention are shown in at least the following US Patents, the entire contents of which are incorporated into reference, and a copy of which is enclosed as if fully set forth in the text of this document: 5,081,794 (Haney); 5,181,342 (Haney); 5,321,913 (Haney); 5,443,414 (Haney); 5,702,287 (Haney); 5,707,273 (Grivna); 4,473,500 (David); 4,837,984 (David); and 4,864,775 (David).

Such machines typically use a platen-mounted abrasive element that comprises an abrasive medium itself, *e.g.*, sandpaper, emery cloth, or in general any thin paper-backed or fabric-backed sheet bearing a layer of finely sized abrasive particles, such as sand, ceramic, and the like. A resilient pad on the non-abrasive side of the abrasive material improves performance. Because of the forces created by very rapid motion required so the abrasive material does not leave scratches and other defects in the workpiece to be finished by the equipment, the supporting metal platen may itself be somewhat permanently mounted in the apparatus or not easily removable, depending on the configuration, so that it does not have a significant amount of mechanical play in its mounting subassembly. Thus, typically, replacement of the abrasive material requires

removal and reconfiguration of any or all of the entire platen, the resilient material, and the abrasive material itself.

Thus, some means of removing the abrasive material (with or without the resilient pad accompanying it) must be provided so that the abrasive material may be changed as required. For example, as disclosed in Figures 5 and 6 and accompanying text of the Haney patents noted above, one approach is to secure an abrasive to the platen around a foam lying between the backside of the abrasive and the platen. Clips are used to secure the edges of the abrasive to the platen. Alternatively or additionally, the abrasive may be secured to the foam and platen by an adhesive. Haney defines 'secured' as meaning that the motion of the abrasive is completely dependent on the motion of the platen. Thus, when the platen moves the abrasive also moves. The foam is positioned between the platen and the abrasive to provide a soft touch to prevent the grit of the abrasive from scratching into a product too deeply. Without the foam, unwanted scratches would result from products that are not perfectly flat. Haney also discloses clips on both sides of the platen, and a spring-biased rod to operate the clips on the back side of the platen. The rod includes a handle and arms. When the handle is pushed down, the rod rotates and the arms contact the clips and cause them to open. The rod can then be locked in place by a locking mechanism. The abrasive is then inserted between the clips and the platen. The clips close when the rod is released. The rod may be secured to a brace.

SUMMARY OF INVENTION

In one embodiment, the invention is a system for rapid replacement of abrasive in machinery having a non-removable platen. In the most preferred embodiment of the invention, one of a set of two rails is on each side of the platen of the apparatus, which rails are movable to increase or decrease the tension on the abrasive material. The abrasive material is frictionally held on each edge to mounts that hold their respective edges within themselves. The mounts are shaped and sized to fit within the rails on each side of the platen. Moving the rails farther apart from each other tightens the abrasive material around the working surface of the platen for normal use, while moving the rails closer together loosens the combination of mounts and abrasive material so that they can be removed as a unit from the apparatus. The edges of the

abrasive material may be easily removed from the mounts by releasing the frictional holding element, and the mounts used again with a different piece of abrasive material. In another embodiment, the invention is a mount having means for frictionally holding the abrasive material. In another embodiment, the invention is an abrasive material having integral, permanent mounts on the edges of the abrasive material, so that the entire combination may be supplied or replaced as a unit that fits into the apparatus.

DESCRIPTION OF THE DRAWINGS

The figures are schematic and provided for illustration only, and thus do not limit the scope of the invention.

Figure 1 shows a side view of a portion of a preferred embodiment of the invention, prior to placement of the abrasive material.

Figure 2 is similar to Figure 1 but includes the abrasive material.

Figure 3 is a close up view of a portion of Figure 2, showing a preferred but not required means for frictionally holding the abrasive material in the mount.

Figure 4 is a schematic view similar to Figure 3.

Figures 5-8 are schematic views illustrating alternative embodiments to that shown in Figures 2, 3 and 4.

DETAILED DESCRIPTION

Figure 1 shows that platen **100** of a surface finishing machine is constructed so that pad **150** is somewhat permanently mounted to platen **100** by any convenient means. "Somewhat permanently" refers to the preferred embodiment, in which pad **150** is mounted to a plate **151**, which in turn is connected to platen **100** in any conventional manner. Thus, plate **151** may be removed only when it is necessary to replace pad **150**, which is not required as frequently as it is may be necessary or desirable to replace the abrasive material, as described below, and platen **100** need not be removed from the

apparatus at all (unless that is the most convenient way to replace pad **150** and plate **151**).

Platen **100** further comprises rails **201** and **202**, at least one of which is moveably and adjustably mounted to the sides of platen **100** so that its longitudinal position with respect to their respective sides of platen **100** may be adjusted by any convenient means. (In this and the other figures, the longitudinal direction is left-to-right or *vice versa* in the plane of the figure. The workpiece having the surface finished by the machine also moves in the longitudinal direction, *i.e.*, longitudinal corresponds to "forward" or "reverse" directions of the workpiece. The transverse direction is into or out of the plane of the figure, *i.e.*, perpendicular to the longitudinal direction in the plane of the workpiece.) For example, the piston illustrated as **230** moves rail **202** longitudinally away from its respective side of platen **100**. In this preferred embodiment, other similar pistons (not shown) behind piston **230** (that is, located transverse to piston **230**) similarly move rail **202** longitudinally away from its respective side of platen **100**. This is only a preferred embodiment, because the scope of the invention includes any subsystem that places the abrasive material (described below) under increased or decreased tension (*i.e.*, a "means for tensioning the abrasive material" or similar language), preferably by moving either or both of rails **201** and **202** with respect to platen **100** (and thus with respect to each other), but not necessarily in the longitudinally opposed directions indicated in the preferred embodiment of the figure. For example, a system of generally cylindrical members could hold an abrasive material in the same general manner as described below, and then either or both members could be rotated about its axis of rotation to increase or decrease the tension on the abrasive material. (The axis of rotation could be a concentric or an eccentric axis.) Thus, the use of pistons as in the preferred embodiment is only a preference, and even if used, the number of pistons is not a limitation on the scope of the invention.

Figure 2 is a view similar to Figure 1, but also shows abrasive material **152** suspended between its edges. Figure 2 shows the invention in a position in which the piston **230** has not been used to increase the distance between rails **201** and **202**, and thus abrasive material **152** is not yet drawn into a taut position. For purposes of the illustration only, the combination of mounts **210** and **211** and abrasive material **152** is

shown partially slid out of working position, towards the viewer (up out of the plane of the figure), but the majority of the length of each mount still lies in its respective rail.

Figure 3 is a close-up view of mount **210**, and Figure 8 is a schematic view similar to Figure 3 but having more detail of preferred but not required features. In this preferred embodiment, mount **210** holds the edge of abrasive material **152** in place with a frictional holding element, specifically shown as the preferred spline **220** that is wedged, along with the edge of abrasive material **152**, into a channel **211** formed within mount **210**, thus frictionally holding abrasive material **152** in mount **210**. The size and configuration of both channel **211** and spline **220** are selected so that there is sufficient frictional coupling against the edge of abrasive material **152** to hold that edge in place. In this regard, Figure 8 schematically indicates the thickness of abrasive material **152**, as less than the thickness would be in actual use, for purposes of clarity only. The circular cross-sectional shape of spline **220** is preferred but not required, as elliptical, rectilinear, wedge-shaped, and other spline shapes are within the scope of the invention.

The exact configuration of mount **210** shown in Figures 3 and 8 is not a requirement of the invention. Nor are the materials selected for mount **210**, which is preferably lightweight extruded aluminum but can be any other material that serves its intended purpose. For example, Figure 8 shows that features such as indent **240** can be included; this feature is an example of how mount **210** may be shaped to reduce the stress on abrasive material **152** in appropriate locations. (A similar stress reduction feature could be provided at corner **241** of rail **201**, if desired.) Spline **220** is preferably a synthetic resilient material but could be a natural material provided that sufficient resilience and strength to perform the functions required by a particular design are provided. The preferred extruded aluminum mount **210** may be formed by a single piece of aluminum stock that is bent to form a hollow frame, the two ends of the material secured to each other by any conventional means.

As illustrated schematically in Figure 7, an alternative embodiment of the abrasive material, denoted as **252**, is formed with an integral feature **320** analogous to frictional holding element **220**. This provides a single disposable unit that may be

rapidly replaced within the surface finishing apparatus according to the principles of the invention.

Figure 4 illustrates schematically the general conceptual arrangement of mount **210**, spline **220**, abrasive material **152**, and rail **201**, to emphasize that specific features illustrated in the previous figures are not necessarily requirements of the invention. In this regard, Figure 5 shows an alternative embodiment, one that illustrates the more general nature of the invention. In general, all that is required is that the edge of the abrasive material **152** be frictionally secured to mount **210** (when a non-integral mount is employed). Channel **211** is shown within the uppermost portion of mount **210** but this is not a requirement of the invention. Frictionally securing abrasive material **152** to mount **210** may not require an inserted frictional holding element **220** if the configuration and materials of mount **210** and/or channel **211** are properly designed. For example, an integral frictional holding element such as a crimp is within the scope of the invention, as illustrated in Figure 6 (which is also schematic and should not be taken as a limitation on the scope of the invention). The crimp **250** schematically represents any feature that extends from a base to grip the abrasive material by compression on at least one surface of the abrasive material. One or more individual or paired crimps **250** may be employed.

The use of a generally rectangular (in cross-section) mount **210** permits abrasive material **152** to be wrapped around mount **210** without subjecting abrasive material **152** to extreme shear and other tearing forces near the edge of abrasive material **152**. Preferred abrasive materials include the so-called "J weight" cloth backed materials, as they are more flexible than "X weight" materials commonly used in the industry. However, other cross-sectional shapes of mount **210** are within the scope of the invention. For example, a generally circular or oval cross-sectional shape could be employed, and a variety of crimp-type features used to hold the edge of the abrasive material in place. The selected shape may also dictate the cross-sectional configuration, size, or other features of rail **201**.

In any embodiment of the invention, the abrasive material need not necessarily have constant grit rating throughout its extent. It is possible to have a dual-value (or, in general, a plurality of values) of grit rating, including a continuously variable grit value,

as one considers various locations along the extent of abrasive material **152**. For example, as the workpiece moves through the apparatus, it could encounter a course grit first, followed by one or more finer grits before leaving the apparatus. This could be accomplished by varying the grit of the material actually attached to abrasive material **152**, or it could be accomplished by assembling abrasive material **152** from two or more pieces of material having different grits, such as by using pressure sensitive or other adhesive to splice or otherwise assemble the pieces together.

The prior art approaches disclosed in the patents above use two separate motors to impart two distinct motions to the platen. In the preferred embodiment, the invention employs a single motor to provide the two distinct motions to the platen.

In cross-sectional view, the mounting of abrasive material **152** appears similar to that shown in US Patent 6,001,004 (Botteghi), assigned on SCM Group, S.p.A. of Rimini, Italy. However, that patent uses a continuous supply of abrasive fed from rollers in a direction transverse to the direction that the workpiece travels. The edges of the abrasive material are not supported in a mount and rail system as described above.